

Date: March 20, 2000

Atty Docket No. GRD0075.US

TO THE ASSISTANT COMMISSIONER FOR PATENTS jc781 U.S. PTO  
Washington, DC 20231



Sir:

03/20/00

Transmitted herewith for filing is the patent application of

Inventor: Gregg Edward Laukhuf

For: USING BARE STRANDED COPPER WIRE FOR GROUNDING TO CONDUIT OR STEEL CHANNEL

Enclosed are:

- [ X ] Two (2) Sheet(s) of Drawings.  
[ X ] An assignment of the invention to Dekko Engineering, Inc.  
[ ] A certified copy of a \_\_\_\_\_ application.  
[ X ] A verified statement to establish small entity status under 37 CFR 1.9 and 37 CFR 1.27.  
[ ] Other \_\_\_\_\_

The filing fee has been calculated as follows:


#1 #2		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR:	FILED EXTRA	RATE	FEE	RATE	FEE
BASIC FEE			\$345.00		\$690.00
TOTAL CLAIMS	18 - 20 = 0	x \$ 9 =	\$ 00.00	OR	x \$ 18 = \$
INDEP CLAIMS	3 - 3 = 0	x \$ 39 =	\$ 00.00	OR	x \$ 78 = \$
MULTIPLE DEPENDENT CLAIMS		+ \$130=	\$ 00.00	OR	+ \$260 = \$
If the difference in Col. 1 is less than zero, enter "0" in Col. 2.		TOTAL	\$345.00	OR	TOTAL \$
		ASSIGNMENT RECORDING FEE (\$40)	\$ 40.00		\$
		TOTAL ENCLOSED	\$385.00		\$

[ X ] A check in the amount of \$385.00 to cover the filing fee is enclosed. (Check No. 5144.)

[ X ] The Commissioner is hereby authorized to charge payment of the following fees or credit any overpayment associated with this communication or during the pendency of this application to Deposit Account No. 20-0095, TAYLOR & AUST, P.C. A duplicate copy of this letter is enclosed.

- [ X ] Any additional filing fees required under 37 CFR 1.16.  
[ X ] Any patent application processing fees under 37 CFR 1.17.  
[ X ] Any fees under 37 CFR 1.16 for presentation of extra claims.

Respectfully submitted,

  
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jc675 U.S. PTO  
09/527880  
03/20/00

"EXPRESS MAIL" COVER LETTER  
U.S. PATENT APPLICATIONS

Date: March 20, 2000

Assistant Commissioner for Patents  
Washington, DC 20231

RE: Application for United States Letters Patent

APPLICANT: Gregg Edward Laukhuf

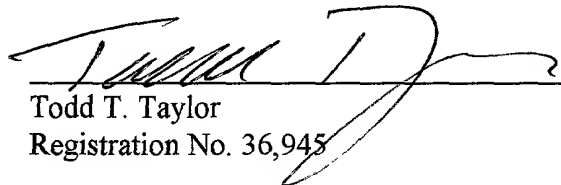
TITLE OF INVENTION: USING BARE STRANDED COPPER WIRE FOR  
GROUNDING TO CONDUIT OR STEEL CHANNEL

Sir:

Forwarded herewith is the above-identified application, consisting of the following:

Specification (6 Sheets)  
Claims (3 Sheets)  
Abstract  
Drawings (2 Sheets)  
Declaration X Executed    Unexecuted  
Verified Statement X Yes    No  
Assignment X Yes    No  
Information Disclosure Statement    Yes X No

Respectfully submitted,

  
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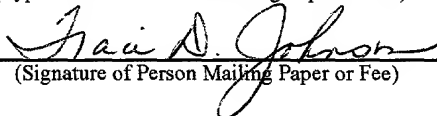
"EXPRESS MAIL" Mailing Number EL549457069US

Date of Deposit March 20, 2000

I hereby certify that this paper or fee is being deposited with the United States Postal Service "EXPRESS MAIL POST OFFICE TO ADDRESSEE" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, DC 20231

Traci D. Johnson

(Typed Name of Person Mailing Paper or Fee)

  
(Signature of Person Mailing Paper or Fee)

APPLICANT OR PATENTEE: Gregg Edward LaukhufAttorney's Docket No. GRD0075 US

SERIAL NO. OR PATENT NO. \_\_\_\_\_

FILED OR ISSUED: \_\_\_\_\_

TITLE: USING BARE STRANDED COPPER WIRE FOR GROUNDING TO CONDUIT OR STEEL CHANNEL

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS**  
**((37 CFR 1.9(f) and 1.27(c)) - SMALL BUSINESS CONCERN**

I hereby declare that I am:

☐ the owner of the small business concern identified below:☒ an official of the small business concern empowered to act on behalf of the concern identified below:NAME OF CONCERN: Dekko Engineering, Inc.ADDRESS OF CONCERN: Pent Division - Plant 2, 2700 County Road 75, Butler, IN 46721

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention entitled:

USING BARE STRANDED COPPER WIRE FOR GROUNDING TO CONDUIT OR STEEL CHANNEL

by inventor(s) Gregg Edward Laukhuf described in:☒ the specification filed herewith.☐ Application Serial No. \_\_\_\_\_, filed \_\_\_\_\_.☐ Patent No. \_\_\_\_\_, issued \_\_\_\_\_.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below\* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by an concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). \*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities (37 CFR 1.27).

FULL NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NON PROFIT ORGANIZATION

FULL NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NON PROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: Russ FretzTITLE OF PERSON OTHER THAN OWNER: Vice President/General ManagerADDRESS OF PERSON SIGNING: Pent Division - Plant 2, 2700 County Road 75, Butler, IN 46721SIGNATURE: DATE: 2-28-00

# **USING BARE STRANDED COPPER WIRE FOR GROUNDING TO CONDUIT OR STEEL CHANNEL**

## **BACKGROUND OF THE INVENTION**

### **1. Field of the invention.**

5           The present invention relates to electrical distribution systems of the type having insulated conductors disposed within a conduit, steel housing, or similar conductive enclosure, for example, of the type which are used in conjunction with prefabricated and prewired office partitions or room divider panels and other modular furniture, and more particularly to methods and apparatus for effecting an electrical grounding of the enclosures of such distribution systems.

### **2. Description of the related art.**

10           Design considerations often call for electrical wiring to be enclosed in a metal housing or enclosure. For example, the power distribution lines used in prewired office space partitions and other modular furniture may be enclosed within a distribution housing, and within flexible steel conduits coupling distributions. Present techniques for grounding a conduit or electrical  
15           distribution housing include external clamping structures coupled to one or both ends of the conduit, a ground wire within the enclosure clamped to the enclosure, and a ground bar which pierces the insulation of a grounded wire and also contacts the surface of the part to be grounded. These techniques are relatively costly, labor intensive, and often ineffective in providing  
20           adequate grounding of enclosures such as extra-flex conduit having a significant linear resistance.

## **SUMMARY OF THE INVENTION**

          The present invention provides a technique of grounding enclosures which is less labor intensive, provides grounding of the enclosure in a number of regions throughout the extent of

the enclosure thereby complying with ground impedance requirements for extra-flex conduits, and reduces the amount of scrap material created during assembly of conductors into the enclosure.

The invention comprises, in one form thereof, a technique of assembling electrical conductors within an elongated electrically conductive enclosure in which a plurality of insulated conductors and a flexible stranded insulation-free conductor are inserted into the enclosure in such a way as to effect probabilistic contact between the insulation-free conductor and the enclosure. This probabilistic contact may be enhanced by bundling the insulated conductors to one another while excluding the insulation-free conductor, for example, by gathered the insulated conductors together into a bundle and wrapping strips of adhesive material about the insulated conductors at a plurality of spaced apart locations.

An advantage of the present invention is that no special connection or assembly step is required to ground the enclosure.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and the invention will be better understood by reference to the following description of embodiments of the invention taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a side elevation view, partly in cross-section, of an electrical distribution incorporating the invention in one form;

Fig. 2 is a view in cross-section along lines 2-2 of Fig. 1;

Fig 3 is a view in cross-section along lines 3-3 of Fig. 1;

Fig. 4 is a side elevation view, partly in cross-section, of an electrical distribution incorporating the invention in another form;

Fig. 5 is a view in cross-section along lines 5-5 of Fig. 4; and

Fig. 6 is a side elevation view, partly in cross-section, of a flexible steel conduit incorporating the invention in a further form.

Corresponding reference characters indicate corresponding parts throughout the several views. The exemplifications set out herein illustrates one preferred embodiment of the invention, in one form, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

### **DETAILED DESCRIPTION OF THE INVENTION**

Referring now to the drawings and particularly to Fig. 1, there is shown an electrical distribution or raceway 12 of the type frequently used in prewired modular furniture. The distribution is typically made of steel or other electrically conductive material and at least has an electrically conductive inner surface portion. The distribution has electrical outlets or receptacles 14 and 16 for receiving office or other equipment plugs. A number of insulated electrical conductors such as 18, 22 and 24 are disposed within the distribution 12 and receive power by way of connectors 26 or 28. Several distributions may be linked together by such connectors. A stranded copper wire or similar flexible conductor 20, which is electrically grounded, extends along the distribution 12. The flexible conductor 20 has no insulation and makes electrical contact with the distribution inner surface in a number of regions such as shown at 52 and 54 thereby effectively grounding the distribution.

It may happen that the ground conductor 20 is isolated from the conductive distribution interior by some of the insulated conductors such as illustrated in Fig. 3. Fig. 4 illustrates one technique for increasing the likelihood of achieving adequate grounding. The several insulated conductors such as 30, 32, 34 and 36 are gathered together in a bundle and held bundled by periodic strips such as the tape strips 38 and 40. The stranded conductor 20 is excluded from the bundle thereby minimizing the likelihood of the conductor 20 being isolated from the housing interior by the insulated conductors. This concept is readily apparent from a comparison of Figs 3 and 5.

In Fig. 6, an illustrative section of flexible steel conduit 42 contains insulated conductors such as 46, 48, and 50 along with a stranded insulation-free copper conductor 44 which is connected to an electrical ground at the left end thereof. The grounding is similar to that shown in Figs. 1-3. The stranded conductor 44 touches and grounds several regions such as 60 and 62 of the conduit 42 interior surface.

Contact between the flexible conductors or ground wires 20 and 44 and the distribution 12 or flexible steel conduit 42 has been described as effecting probabilistic contact or contact at randomly distributed locations along the enclosure. "Randomly" is not used in the narrow sense of probability theory, rather, it expresses a lack of certainty. For example, if a certain enclosure region is grounded, the probability that a closely adjacent region is also grounded is much greater than if nothing near the second region is grounded because the ground conductor is close to the enclosure in that area. The contact occurs randomly along the enclosure because it is not known where nor if contact will occur. There are numerous ways to define a probability measure for this grounding technique. For example, the inner surfaces of the enclosures illustrated may be

thought of as being subdivided into a number  $n$  of circular or rectangular annuli. Numerous replications of an experimental insertion of a certain number of insulated conductors and a ground conductor may be performed and the number of annuli in which grounding contact occurs, for each replication, counted. A histogram may then be drawn with the number of annuli along the length of the enclosure as abscissa and the number of annuli found to be grounded as ordinate. If, for example, seven out of all the replications of the experiment yielded grounding of 23 annuli, the rectangle of the histogram located at  $n=23$  would be 7 units high. As the number of annuli in the subdivision is increased, the histogram tends to become a smooth continuous frequency distribution. With the frequency distribution established by an adequate number of replications, the probability of achieving at least a certain number of grounded annular regions along the enclosure for the particular enclosure geometry, and the number and type of conductors, is simply the area under the distribution to the right of the particular number.

The particular distribution is a function of the geometry of the enclosure, the number and rigidity of the conductors and numerous other factors. If it is desired to increase the probability of achieving adequate grounding, that is, to skew the distribution further toward the right, any of several techniques could be employed. The gathering or bundling together of some or all of the insulated conductors as shown in Figs. 4 and 5 enhances the likelihood of achieving at least some specified number of grounded annuli. Also, making the ground conductor 20 or 44 of a greater number of strands, or of less tightly twisted strands increases the ground conductor flexibility and serves to skew the distribution further to the right. Of course, a reduction of the number of insulated conductors or increasing the number of ground conductors would also achieve an increase in the likelihood of achieving adequate grounding.



In summary, the probabilistic grounding of an elongated electrically conductive enclosure is achieved by introducing a flexible stranded insulation-free conductor into the enclosure along with a plurality of insulated conductors, bundling the insulated conductors together, terminating the insulation-free conductor near at least one end thereof to an electrical ground, and  
5 allowing the insulation-free conductor to contact the enclosure interior in a plurality of randomly distributed locations along the elongated extent thereof. The bundling enhances the random grounding by preventing the insulated conductors from isolating the insulation free conductor from the enclosure. For flexible conduit having significant linear resistance, the conventional technique of providing grounding clamps at one or both conduit ends leaves a central conduit  
10 portion which is not effectively grounded. The grounding of numerous intermediate conduit regions provided by the present invention solves this problem.

While this invention has been described as having a preferred design, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its  
15 general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.

## WHAT IS CLAIMED IS:

1. An electrical power distribution system, comprising:

a hollow elongated conductive enclosure;

a plurality of elongated insulated conductors disposed within the enclosure;

a plurality of wraps spaced along, and each surrounding, the plurality of insulated

5 conductors; and

a flexible electrical conductor having an exposed electrically conductive surface within the enclosure making electrical contact with the enclosure interior in a plurality of randomly distributed regions along the length of the enclosure.

2. The electrical power distribution system of claim 1, wherein each of the wraps comprises a strip of adhesive tape confining the plurality of insulated conductors in a bundle and excluding the flexible conductor from the bundle.

3. The electrical power distribution system of claim 1, wherein the flexible electrical conductor comprises an insulation-free stranded copper wire conductor.

4. The electrical power distribution system of claim 1, wherein the flexible electrical conductor is terminated near at least one end to an electrical ground.

5. The electrical power distribution system of claim 1, wherein the hollow elongated enclosure comprises a flexible metal conduit.

6. The electrical power distribution system of claim 1, wherein the hollow elongated enclosure comprises a modular furniture distribution.

7. A process of assembling electrical conductors within an elongated electrically conductive enclosure, comprising the steps of:

inserting a plurality of insulated conductors into the enclosure;

inserting a flexible stranded insulation-free conductor into the enclosure; and

5 effecting probabilistic contact between the insulation-free conductor and the enclosure.

8. The process of claim 7, wherein the probabilistic contact is enhanced by bundling the insulated conductors to one another.

9. The process of claim 8, wherein bundling comprises the step of wrapping strip material about all of the insulated conductors at a plurality of spaced apart locations.

10. The process of claim 9, wherein the strip material comprises an adhesive tape.

11. The process of claim 7, wherein the hollow elongated enclosure comprises a modular furniture distribution.

12. The process of claim 7, wherein the hollow elongated enclosure comprises a flexible metal conduit.

13. The process of claim 7, including the additional step of terminating the insulation-free conductor near at least one end thereof to an electrical ground.

14. A process of probabilistically grounding an elongated electrically conductive enclosure, comprising the steps of:

introducing a flexible stranded insulation-free conductor into the enclosure;

introducing a plurality of insulated conductors into the enclosure;

5 bundling the insulated conductors;

terminating the insulation-free conductor near at least one end thereof to an electrical ground; and

allowing the insulation-free conductor to contact the enclosure interior in a plurality of randomly distributed locations along the elongated extent thereof, the bundling preventing the insulated conductors from isolating the insulation free conductor from the enclosure.

15. The process of claim 14, wherein the step of bundling comprises wrapping strip material about all of the insulated conductors at a plurality of spaced apart locations.

16. The process of claim 15, wherein the strip material comprises an adhesive tape.

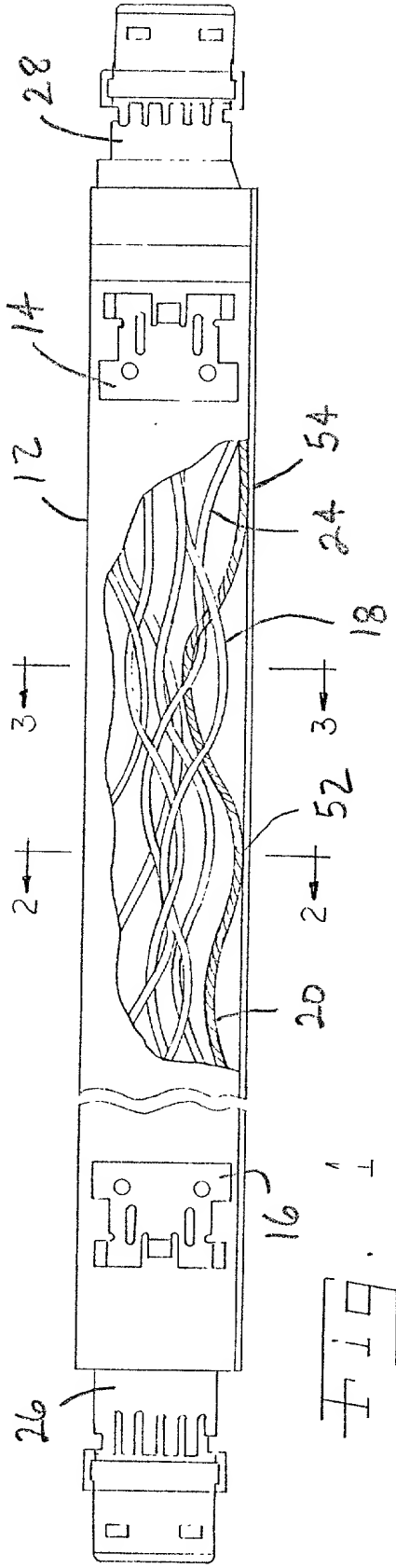
17. The process of claim 14, wherein the hollow elongated enclosure comprises a modular furniture distribution.

18. The process of claim 14, wherein the hollow elongated enclosure comprises a flexible metal conduit.

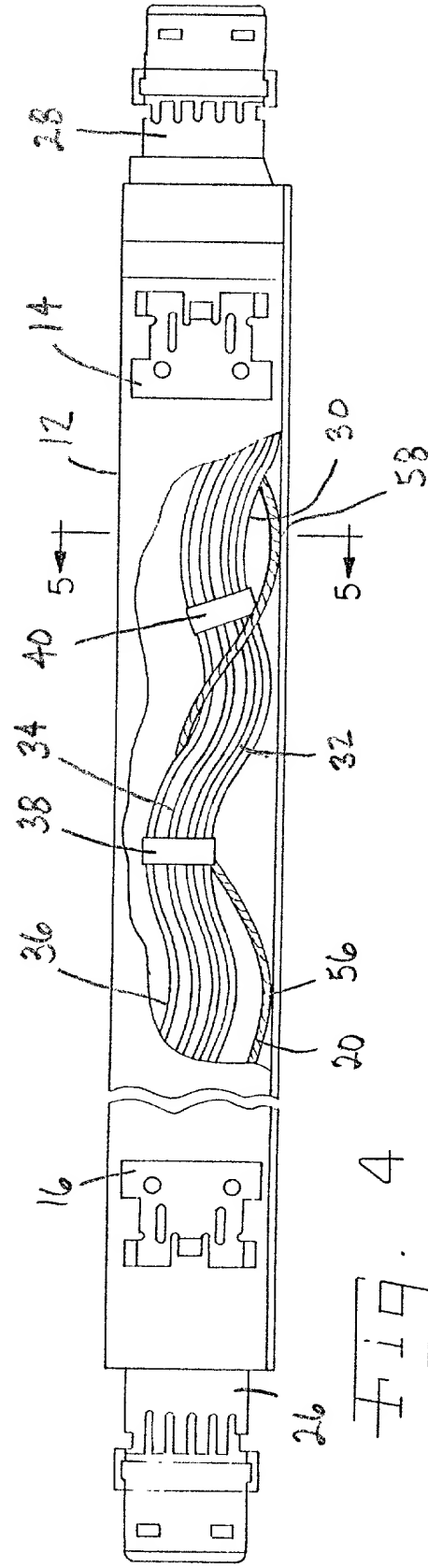
## **ABSTRACT OF THE DISCLOSURE**

An electrical power distribution system including a hollow elongated enclosure such as flexible metal conduit, a modular furniture distribution, or similar enclosure has a plurality of elongated insulated conductors within the enclosure, and a plurality of wraps spaced along, and each surrounding, the plurality of insulated conductors. There is also a flexible electrical ground conductor having an exposed electrically conductive surface within the enclosure making electrical contact with the enclosure interior in a plurality of randomly distributed regions along the length of the enclosure thereby randomly grounding enclosure regions throughout the extent of elongation. The wraps may comprise strips of adhesive tape confining the plurality of insulated conductors in a bundle and excluding the flexible conductor from the bundle.

5

[illegible]

五十一



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## DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that.

My residence, post office address and citizenship are as stated below next to my name:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled.

USING BARE STRANDED COPPER WIRE FOR GROUNDING TO CONDUIT OR STEEL CHANNEL

the specification of which:

[ X ] is attached hereto.

[ ] was filed on \_\_\_\_\_ as

Application Serial No. \_\_\_\_\_

and was amended on \_\_\_\_\_.

(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119, of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

## PRIOR FOREIGN APPLICATION(S)

## Priority Claimed

_____ (Number)	_____ (Country)	_____ (Month/Day/Year Filed)	[ ] Yes	[ ] No
_____ (Number)	_____ (Country)	_____ (Month/Day/Year Filed)	[ ] Yes	[ ] No

I hereby claim the benefit under Title 35, United States Code, §120, of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a), which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status)(patented, pending, abandoned)
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

As a named inventor, I hereby appoint Todd T. Taylor, Reg. No. 36,945; Ronald K. Aust, Reg. No. 36,735; Keith J. Swedo, Reg. No. 43,176; Raymond W. Campbell, Reg. No. 29,902 and Jeffrey T. Knapp, Reg. No. P-45,384 of the firm of TAYLOR & ASSOCIATES, P.C., as attorney(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

SEND CORRESPONDENCE TO:

DIRECT TELEPHONE CALLS TO:

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Todd T. Taylor

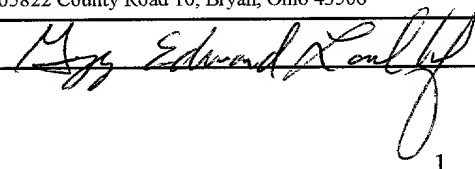
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Inventor's Signature: 

Date: 3-13-00